

WHAT IS CLAIMED IS:

1 1. In an optical communication system comprising a plurality of optical
2 transmission devices, a method for monitoring optical transmission paths provided by said
3 optical transmission devices, said method comprising:
4 receiving a first instruction signal of a first type at a first of said optical
5 transmission devices;
6 receiving a second instruction signal of a second type at a second of said
7 optical transmission devices;
8 receiving a third instruction signal of a third type at a third of said optical
9 transmission devices;
10 receiving a first transmission signal at said first optical transmission device
11 and in accordance with said first instruction signal, combining a first monitoring information
12 signal with said first transmission signal to produce a modified first transmission signal and
13 transmitting said modified first transmission signal to one of said optical transmission
14 devices, said first monitoring information signal representative of first optical transmission
15 path monitoring parameters;
16 receiving a second transmission signal at said second optical transmission
17 device and in accordance with said second instruction signal, transmitting said second
18 transmission signal to one of said optical transmission devices, said second transmission
19 signal comprising a second monitoring information signal representative of second optical
20 transmission path monitoring parameters; and
21 receiving a third transmission signal at said third optical transmission device
22 and in accordance with said third instruction signals, performing end-point processing based
23 on a third monitoring information signal contained in said third transmission signal, said third
24 monitoring information signal representative of third optical transmission path monitoring
25 parameters.

1 2. The method of claim 1 further including receiving user input
2 representative of said first, second, and third optical transmission path monitoring parameters.

1 3. The method of claim 1 wherein a first portion of said first instruction
2 signal is representative of said first optical transmission path monitoring parameters, said first
3 monitoring information signals being based on said first portion.

1 4. The method of claim 1 further including transmitting said first, second,
2 and third instruction signals from a first location.

1 5. The method of claim 4 wherein said end-point processing includes
2 transmitting monitor processing result signals to said first location.

1 6. The method of claim 4 wherein said first location is an optical
2 transmission network administration device.

1 7. The method of claim 1 wherein said first, second, and third
2 transmission signals are frame signals, and said first, second, and third monitoring
3 information signals, respectively, are portions of said frame signals.

1 8. In an optical transmission device disposed in an optical transmission
2 path, a method for monitoring said optical transmission path comprising:
3 receiving a first instruction signal of a first type and in response thereto
4 modifying a first received transmission signal to include a first monitoring information signal
5 to produce a modified transmission signal, and transmitting said modified transmission
6 signal;

7 receiving a second instruction signal of a second type and in response thereto
8 transmitting a second received transmission signal, a portion of which includes a second
9 monitoring information signal, said transmitting being performed without modification to
10 said second monitoring information; and

11 receiving a third instruction signal of a third type and in response thereto
12 performing end-point processing based on a third monitoring information signal, said third
13 monitoring information signal being a portion of a third received transmission signal.

1 9. The method of claim 8 wherein a first portion of said first instruction
2 signal is representative of optical transmission path monitoring parameters, said first
3 monitoring information signal being based on said first portion.

1 10. The method of claim 8 wherein said first, second, and third instruction
2 signals are received from a first location.

1 11. The method of claim 10 wherein said end-point processing includes
2 transmitting monitor processing result signals to said first location.

1 12. In an optical path comprising a plurality of optical transmission
2 devices for transmission of a transmission signal therealong, each device receiving said
3 transmission signal and transmitting said transmission signal, a method for monitoring said
4 optical transmission path comprising:

5 identifying a first set of said optical transmission devices associated with a
6 first monitoring zone, said first set of optical transmission devices including first and second
7 optical transmission devices designated as first and second end-point devices, the remaining
8 optical transmission devices in said first set being designated as first relay devices;

9 identifying a second set of said optical transmission devices associated with a
10 second monitoring zone, said second set of optical transmission devices including third and
11 fourth optical transmission devices designated as third and fourth end-point devices, the
12 remaining optical transmission devices in said second set being designated as second relay
13 devices;

14 transmitting first and second insertion-type instruction signals respectively to
15 said first and third end-point devices, said first end-point device thereby modifying said
16 transmission signal by inserting a first monitoring information signal into a first portion of
17 said transmission signal and transmitting said transmission signal as modified, said third end-
18 point device thereby modifying said transmission signal by inserting a second monitoring
19 information signal into a second portion of said transmission signal and transmitting said
20 transmission signal as modified;

21 transmitting passthrough-type instruction signals to said first relay devices and
22 to said second relay devices; and

23 transmitting end-point processing type instruction signals to said second and
24 fourth end-point devices.

1 13. The method of claim 12 further including receiving user-provided
2 information representative of said first and second monitoring zones, wherein said optical
3 transmission devices comprising said first and second sets are dependent on said user-
4 provided information.

1 14. The method of claim 12 wherein if said first and second monitoring
2 zones overlap such that some of said optical transmission devices belong both to said first set
3 of optical transmission devices and to said second set of optical transmission devices, then
4 said first and second portions of said transmission signal are different portion.

1 15. The method of claim 12 wherein if said first and second monitoring
2 zones do not overlap, then said first and second portions of said transmission signal are the
3 same portion.

1 16. The method of claim 12 further including for each of said first relay
2 devices and each of said second relay devices, in response to receiving said passthrough-type
3 instruction signals, transmitting a received transmission signal which includes monitoring
4 information signals in a manner that does not modify said monitoring information signals.

1 17. The method of claim 12 further including for each of said second and
2 fourth end-point devices, in response to receiving said end-point processing type instruction
3 signal, performing end-point processing based on monitoring information signals contained
4 in a received transmission signal.

1 18. The method of claim 12 wherein a first portion of each of said first and
2 second insertion-type instruction signals is representative of optical transmission path
3 monitoring parameters, said first monitoring information signals being based on said first
4 portion of said first insertion-type instruction signal, said second monitoring information
5 signals being based on said first portion of said second insertion-type instruction signal.

1 19. The method of claim 12 further including transmitting said insertion-
2 type, said passthrough-type, and said end-point type instruction signals from a first location.

1 20. The method of claim 19 wherein said end-point processing includes
2 transmitting monitor processing result signals to said first location.

1 21. An optical network system comprising:
2 an administration device; and
3 a plurality of optical transmission devices, said optical transmission devices
4 providing at least one optical transmission path for transmission of a transmission signal,
5 said administration device in communication with each of said optical
6 transmission devices,
7 said administration device configured to identify a first set of said optical
8 transmission devices associated with a first monitoring zone, said first set of optical
9 transmission devices including first and second optical transmission devices designated

10 respectively as first and second end-point devices, the remaining optical transmission devices
11 in said first set being designated as first relay devices;
12 said administration device configured to transmit a first insertion-type
13 instruction signal to said first end-point device,
14 said administration device configured to transmit passthrough-type instruction
15 signals to said first relay devices,
16 said administration device configured to transmit an end-point processing type
17 instruction signal to said second end-point device,
18 said optical transmission devices each configured to modify said transmission
19 signal by inserting a first monitoring information signal into a first portion of said
20 transmission signal and to transmit said transmission signal as modified, in response to
21 receiving an insertion-type instruction signal,
22 said optical transmission devices each configured to transmit said transmission
23 signal without inserting an additional monitoring information signal, or deleting or modifying
24 said first monitoring information signal, in response to receiving a passthrough-type
25 instruction signal,
26 said optical transmission devices each configured to perform end-point
27 processing based on said first monitoring information signal, in response to receiving an end-
28 point type instruction signal.

1 22. The optical network system of claim 21 wherein said administration
2 device is further configured to receive user-provided information relating to said first
3 monitoring zone.

1 23. The optical network system of claim 21 wherein
2 said administration device is further configured to identify a second set of said
3 optical transmission devices associated with a second monitoring zone, said second set of
4 optical transmission devices including third and fourth optical transmission devices
5 designated respectively as third and fourth end-point devices, the remaining optical
6 transmission devices in said second set being designated as second relay devices,
7 said administration device configured to transmit a second insertion-type
8 instruction signal to said third end-point device,
9 said optical transmission devices each further configured to modify said
10 transmission signal by inserting a second monitoring information signal into said first portion

11 of said transmission signal or to a second portion of said transmission signal, in response to
12 receiving an insertion-type instruction signal,
13 said first and second portions either being the same portion of said
14 transmission signal or different portions of said transmission signal depending on whether
15 said first and second monitoring zones overlap wherein some of said optical transmission
16 devices in said first group also belong to said second group.

1 24. The optical network system of claim 21 wherein said administration
2 device is further configured to receive user-provided information relating to optical
3 transmission path monitoring parameters, said first insertion-type instruction signal having a
4 first portion representative of said optical transmission path monitoring parameters, said first
5 monitoring information signal being based on said first portion.

6 25. The optical network system of claim 21 wherein said end-point
7 processing includes transmitting monitor processing results to said administration device.

8 26. In an optical network system comprising a plurality of optical
9 transmission devices providing at least one optical transmission path for transmission of a
10 transmission signal, an administration device comprising:
11 means for communicating with each of said optical transmission devices;
12 means for receiving user-provided information which specifies a first
13 monitoring zone;
14 means for identifying a first set of said optical transmission devices associated
15 with said first monitoring zone, said first set of optical transmission devices including first
16 and second optical transmission devices designated as first and second end-point devices, the
17 remaining optical transmission devices in said first set being designated as first relay devices;
18 first means for producing a first insertion-type instruction signal for
19 transmission to said first end-point device, a first portion of said insertion-type instruction
signal representative of optical transmission path monitoring parameters, said insertion-type
instruction signal effective on said optical transmission devices to modify said transmission
signal by inserting a first monitoring information signal into a first portion of said
transmission signal and transmitting said transmission signal as modified, said first
monitoring information signal being based on said first portion;
second means for producing plural passthrough-type instruction signals for
transmission to said first relay devices, each passthrough-type instruction signal effective on

20 said optical transmission devices to transmit said transmission signal without inserting an
21 additional monitoring information signal, or deleting or modifying said first monitoring
22 information signal; and
23 third means for producing an end-point processing type instruction signal for
24 transmission to said second end-point device, said end-point type instruction signal effective
25 on said optical transmission devices to perform end-point processing based on said first
26 monitoring information signal.

1 27. The optical network system of claim 26 wherein said first insertion-
2 type instruction signal further includes a second portion thereof which specifies said first
3 portion of said transmission signal into which said first monitoring information signal is
4 inserted.

5 28. The optical network system of claim 26 wherein said means for
6 receiving includes receiving user-provided information which specifies a second monitoring
7 zone, said means for identifying includes identifying a second set of said optical transmission
8 devices including third and fourth optical transmission devices designated as third and fourth
9 end-point devices, the remaining optical transmission devices in said second set being
10 designated as second relay devices, said first means for producing includes producing a
11 second insertion-type instruction for transmission to said third end-point device.

1 29. The optical network system of claim 28 wherein said first and second
2 sets include one or more optical transmission devices in common, said first insertion-type
3 instruction signal further includes a second portion thereof which specifies said first portion
4 of said transmission signal into which said first monitoring information signal is inserted, said
5 second insertion-type instruction signal further includes a second portion thereof which
6 specifies a second portion of said transmission signal into which a second monitoring
7 information signal is inserted.

1 30. In an optical network system comprising an administration device in
2 communication with a plurality of optical transmission devices, said optical transmission
3 devices providing at least one optical transmission path for transmission of a transmission
4 signal, each optical transmission device comprising:
5 first means for receiving instruction signals from said administration device;
6 second means for receiving said transmission signal;

third means for transmitting said transmission signal; and
fourth means for modifying said transmission signal coupled to receive said transmission signal from said second means and coupled to transmit said transmission signal via said third means,
said fourth means including a fifth means for identifying an insertion-type instruction signal wherein, upon receiving said transmission signal, it is modified by inserting a first monitoring information signal into a first portion of said transmission signal, said transmission signal as modified being subsequently transmitted by via said third means,
said fourth means further including sixth means for identifying a passthrough-type instruction signal wherein, upon receiving said transmission signal, it is subsequently transmitted without inserting an additional monitoring information signal, or deleting or modifying said first monitoring information signal,
said fourth means further including seventh means for identifying an end-point processing type signal wherein, upon receiving said transmission signal, end-point processing is performed based on said first monitoring information signal contained in said transmission signal.

31. In an optical transmission system comprising a plurality of optical transmission devices for transmission of a transmission signal therealong, each device receiving said transmission signal and transmitting said transmission signal, a method for providing optical transmission service based on monitoring optical transmission paths comprising:

identifying a first set of said optical transmission devices associated with a first monitoring zone, said first set of optical transmission devices including first and second optical transmission devices designated as first and second end-point devices, the remaining optical transmission devices in said first set being designated as first relay devices;

identifying a second set of said optical transmission devices associated with a second monitoring zone, said second set of optical transmission devices including third and fourth optical transmission devices designated as third and fourth end-point devices, the remaining optical transmission devices in said second set being designated as second relay devices;

transmitting first and second insertion-type instruction signals respectively to said first and third end-point devices, said first end-point device thereby modifying said transmission signal by inserting a first monitoring information signal into a first portion of

18 said transmission signal and transmitting said transmission signal as modified, and said third
19 end-point device thereby modifying said transmission signal by inserting a second monitoring
20 information signal into a second portion of said transmission signal and transmitting said
21 transmission signal as modified;
22 transmitting passthrough-type instruction signals to said first relay devices and
23 to said second relay devices;
24 transmitting a first end-point processing type instruction signal to said second
25 end-point device and in response thereto, performing end-point processing based on a first
26 monitoring information signal contained in a first received transmission signal including
27 transmitting a first monitor processing result signal to a first location;
28 transmitting a second end-point processing type instruction signal to said
29 fourth end-point device and in response thereto, performing end-point processing based on a
30 second monitoring information signal contained in a second received transmission signal
31 including transmitting a second monitor processing result signal to said first location;
32 charging for optical transmission service in said first monitoring zone based
33 on information represented by said first monitor processing result signal; and
34 charging for optical transmission service in said second monitoring zone based
35 on information represented by said second monitor processing result signal.

1 32. The method of claim 31 wherein if said first and second monitoring
2 zones overlap such that some of said optical transmission devices belong both to said first set
3 of optical transmission devices and to said second set of optical transmission devices, then
4 said first and second portions of said transmission signal are different, otherwise said first and
5 second portions are the same.

1 33. The method of claim 31 further including for each of said first relay
2 devices and each of said second relay devices, in response to receiving said passthrough-type
3 instruction signals, transmitting a received transmission signal which includes monitoring
4 information signals in a manner that does not modify said monitoring information signals.

1 34. The method of claim 31 wherein a first portion of each of said first and
2 second insertion-type instruction signals is representative of optical transmission path
3 monitoring parameters, said first monitoring information signals being based on said first
4 portion of said first insertion-type instruction signal, said second monitoring information
5 signals being based on said second portion of said second insertion-type instruction signal.

1 35. The method of claim 31 further including transmitting said insertion-
2 type, said passthrough-type, and said end-point type instruction signals from said first
3 location.